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INDUSTRIAL PROCESS PROFILES FOR ENVIRONMENTAL USE: Chapter 23 The Rice Industry

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16. ABSTRACT

The catalog of Industrial Process Profiles for Environmental Use was developed as an aid in defining the environmental impacts of industrial activity in the United States. Entries for each industry are in consistent format and form separate chapters of the study. Mica is a group name for a number of complex hydrous potassium-aluminum silicate minerals characterized by excellent cleavage and by a high degree of flexibility, elasticity, and toughness of extremely thin cleavage flakes. The Mica industry has been divided into two segments for consideration: (1) Mica Production and (2) Mica Disc Production. One chemical tree, two process flow sheets and nine process descriptions have been prepared to characterize the industry. Within each process description available data have been presented on input materials, operating parameters, utility requirements and waste streams. Data related to the subject matter, including company, product and raw material data, are included as appendices.

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INDUSTRIAL PROCESS PROFILES

FOR ENVIRONMENTAL USE

CHAPTER 20

THE MICA INDUSTRY

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MICA

INDUSTRY DESCRIPTION

Mica is a group name for a number of complex hydrous potassium-aluminum silicate minerals having similar physical properties. Mica minerals are characterized by excellent basal cleavage and by a high degree of flexibility, elasticity, and toughness of extremely thin cleavage flakes.

The mica industry has been divided into two segments for consideration. The largest segment, Mica Production, consists of open-pit mining of mica ore minerals, beneficiating of the mineral ore, and grinding of the mica to desired sizes. Another segment is the Mica Disc Production Segment which processes imported sheet mica.

Domestically mined mica ore yields "flake or scrap" mica while nearly all "sheet" mica is imported. Sheet mica must be relatively flat, free from most defects, and large enough to be cut into pieces at least 4.8 cm^2.

Industry processes are shown on Figures 2 and 3. Processing of flake mica begins with wet or dry mining of mica ore. The ore is then crushed and the mica is separated from gangue by screening or by passing through a Humphreys spiral. The resulting flake mica is then dried. A portion is marketed as flake mica, but the majority is either dry-ground ($\sim$85 percent) or wet-ground ($\sim$15 percent). Wet-grinding produces a finer, more valuable product than dry-grinding. Scrap mica from various other sources is also ground with mined scrap mica. The wet-ground mica is then dried before bagging. Processing of imported "sheet mica" primarily involves punching of it to form mica discs.

In 1975, 27 companies mined mica ore at 34 locations. Twenty-three companies operated a total of 28 plants which ground scrap and flake mica. Sheet mica was processed by 12 companies. It is estimated that 450 people were employed in the industry.

In 1973 the total domestic production of scrap and flake mica was 161,000 metric tons with a value of approximately $6,100,000. Production of ground mica was 123,000 metric tons, and its value was $9,400,000. Imports included 531 metric tons of uncut sheet mica valued at $1,270,000, 2,170 metric tons of manufactured mica valued at $4,325,000, and 2,300 metric tons of scrap valued at $116,000.

In 1973, North Carolina accounted for 60 percent of flake and scrap mica production. The remaining output of scrap and flake mica comes from Alabama, Arizona, Connecticut, Georgia, New Mexico, and South Carolina. In 1975, mica was being mined in the additional states of California, Colorado, Massachusetts, South Dakota, and Texas.

Most mining operations for mica are located in low population density

areas such as the western part of North Carolina. Grinding plants are located near mines.

Scrap and flake mica production increased from 121,000 metric tons in 1969 to 161,000 metric tons in 1973 and then decreased back to 121,000 metric tons in 1974. Despite the lower production in 1974 which was due to low consumption by the building industries, the demand is expected to grow at an annual rate of 3.7 ± 1 percent. At that rate demand will be between 500,000 metric tons and 1,000,000 metric tons by the year 2000.

It is unlikely that future domestic production of sheet mica will be significant. Sheet mica is imported primarily from India, Brazil, and the Malagasy Republic where low manual labor costs make its production economical.

No information is available concerning on-site power or steam generation in the mica industry.

Raw Materials

Mica is chiefly composed of hydrous potassium-aluminum silicate compounds. Muscovite, "potassium mica", has the general formula $K_2Al_4(Al_2Si_6O_{20})(OH)_4$. This is the variety of mica that is produced in the United States. Another variety produced only outside the U.S. is "magnesium mica", with the general formula $K_2(Mg\ Fe^{++})_6AL_2Si_6O_2F_4(OH)_4$.

Flake or scrap mica is mined from pegmatites, granite, and mica-rich metamorphic rocks. Scrap is also a by-product of mining sheet mica (insignificant in the U.S.), trimming sheet mica, and fabricating sheet mica. It can also be recovered from schists or from the beneficiation of feldspar and kaolin.

The content of recoverable mica from presently mined deposits ranges from 3 to 20 percent. Ore requirements for producing the 161,000 metric tons of flake mica in 1973 are estimated to have been approximately 2,000,000 tons.

The disposal of solid wastes from open-pit mining and ore beneficiation is a problem. Since recoverable mica content of mined ore varies from 3 to 20 percent,[a] the disposal of large quantities of gangue is necessary. Craters left from open-pit mining are a second environmental problem. Mica ores are non-toxic and do not create an environmental hazard in themselves.

Products

Ground mica comprised approximately 80 percent of the scrap-and flake-mica production in 1973. The other 20 percent was accounted for by losses in grinding plus marketing of flake mica for use in reconstituted mica. Dry-ground mica accounted for 88 percent of total ground

[a]Schist ore contains up to 90 percent mica, but it is not certain that these deposits are being mined.

mica sales. It is used principally in joint cement, paint, rolled roofing, and asphalt shingles. Wet-ground mica is used chiefly in wallpaper, rubber goods, and paint. Final uses of ground mica in 1973 are listed in Table 1.

Sheet mica is used as a di-electric and insulating material in electronic and electrical equipment, in shields for high-temperature steam-gage glasses, and as regulator diaphragms. Replacements for sheet mica such as reconstituted and glass-bonded mica, organic polymers, synthetic mica, alumina ceramics, fused quartz, and talc are predicted to decrease and possibly eliminate the need for it by the year 2000. In 1970, production of sheet mica did not occur in the United States for the first time in over 100 years. Since then, very small amounts of low quality sheet mica have been produced. Imports of all forms of sheet mica in 1973 were 2,700 metric tons.

Companies

Companies operating in the mica industry are generally rather small organizations whose primary business is processing of mica. Production is spread among a large number of companies with no single firm dominating.

Twenty-seven companies operating 34 mines were producing crude flake mica in 1975. These companies and the mine locations are listed in Appendix A. The following companies account for approximately 80 percent of the total production:

Buckeye Mica Company
Deneen Mica Company
The Feldspar Corporation
Franklin Mineral Products Company
Harris Mining Company
Jones Mining Company, Inc.
Kings Mountain Mica Company, Inc.
Mineral Industrial Commodities of America, Inc.
Mineral Mining Corporation
Thompson-Weinman and Company
Western Mica Company

Twenty-three companies operating 28 plants were grinding flake and scrap mica in 1975. These companies and plant locations are listed in Appendix A. The following companies account for approximately 75 percent of the total wet-and dry-ground mica production:

Asheville Mica Company
Deneen Mica Company
Diamond Mica Company
Franklin Mineral Products Company
General Electric Company
Harris Mining Company
Kings Mountain Mica Company, Inc.
Micalith Mining Company, Inc.
U. S. Gypsum Company

Table 1. MICA APPLICATION AND CONSUMPTION DURING 1973

	Application	Quantity Consumed 10^3 Metric Tons	%
Domestic Ground Mica	Joint Cement	46.5	38
	Paint	34.0	28
	Roofing	19.6	16
	Rubber	5.2	4
	Wallpaper	0.4	0.3
	Plastics	0.4	0.3
	Other	16.4	13
	Total	122.5	
Imported Sheet Mica	Vacuum Tubes	0.4	
	Other	0.2	
	Film Mica	0.005	
	Built-up Mica (from splittings)	2.1	

Twelve companies operating 12 fabricating plants were punching sheet mica splittings into discs in 1975. These companies along with plant locations are listed in Appendix A. The following companies account for approximately 90 percent of the total production:

American Mica Insulation Company
Asheville Mica Company
Cleveland Mica Company
Industrial Mica Company
Micacraft Products, Inc.
Mica Fabricating Company
New England Mica Company, Inc.
Spruce Pine Mica Company, Inc.
The Tar Heel Mica Company, Inc.
Victory Mica Manufacturing Company, Inc.

Environmental Impact

Dust from mining, grinding and screening is a source of emissions No quantitative information is available. A more pressing problem is disposal of gangue materials from ore beneficiation and overburden from mining. Another problem is craters formed by unused or abandoned open-pit mines. Gangue materials and dust are non-toxic.

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INDUSTRY ANALYSIS

The mica industry is relatively small by most standards. Data from the literature are often incomplete and scanty. For example, very little information on dust emissions is available. Data given on waste streams are estimates.

Often an estimated range of inputs, utilities, or waste streams is given rather than a single value. This was done because the values depend upon the concentration of mica in the ore; the size of mining, beneficiating, and grinding equipment, and other factors. Data were taken from sources which are considered to be reliable, up-to-date, and accurate.

The chemical tree of Figure 1 gives a qualitative overview of the mica industry from a raw material-product-use standpoint. The four major domestic products are dry-ground mica, wet-ground mica, flake mica, and mica discs.

Flowsheets for both segments of the mica industry are included. Figure 2 represents the Mica Production Segment, and Figure 3 represents the Mica Disc Production Segment. The interior of each of the rectangular "process blocks" appearing on the flowsheet represents at least one of the sequential, real processes of the mica industry. A number and title have been placed within each of the process blocks. These identifying symbols are used in the process descriptions later in this report.

The flowsheet of Figure 2 shows the processes used in the mica industry. The interior of each of the rectangular "process blocks" appearing on the flowsheet represents at least one of the sequential, real processes of the mica industry. A number and title have been placed within each of the process blocks. These identifying symbols are used in the process descriptions later in this report.

Flag symbols at the upper right-hand corner of the process block indicate the nature of the waste streams, if any, discharged from the process. A circle is used for atmospheric emissions, a triangle for liquid wastes, and a rhombus for solid waste. The flags do not differentiate between inadvertent (fugitive) and designed wastes.

A verbal process description has been written to characterize each process further; to relate it to other processes and quantify its operating parameters.

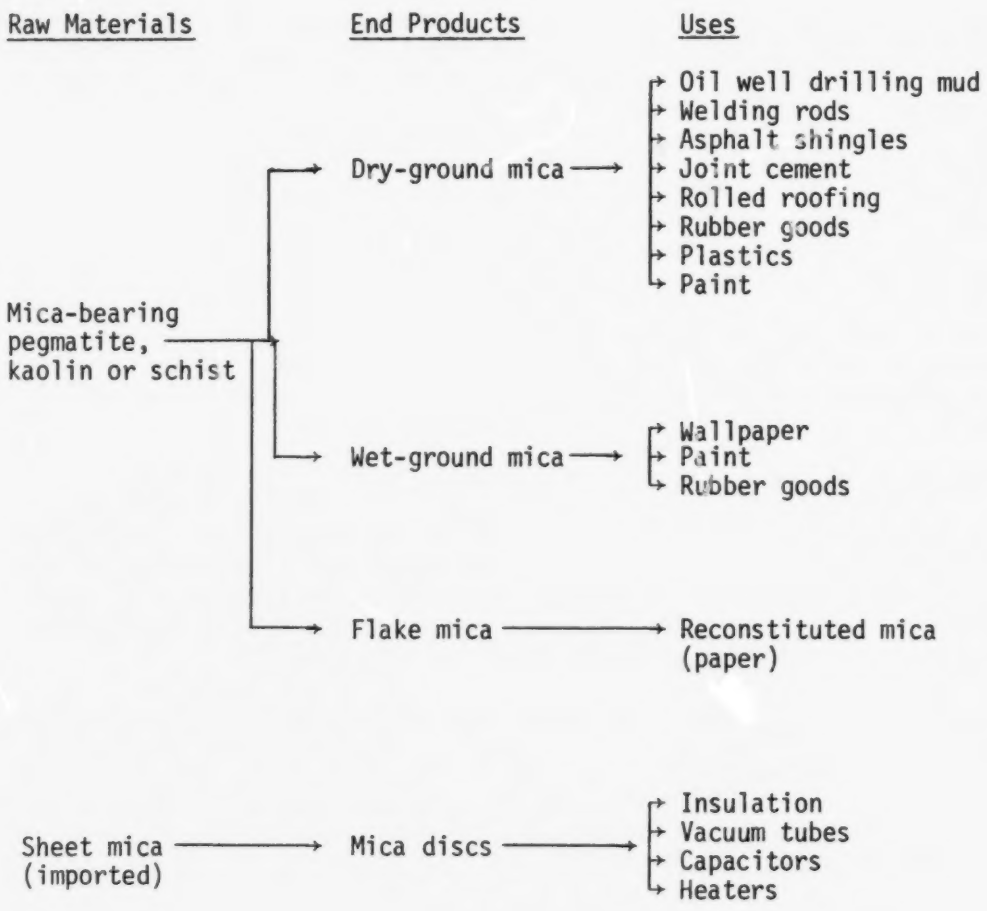

Figure 1. MICA INDUSTRY CHEMICAL TREE

MICA PRODUCTION

The operations of the Mica Production Segment are defined by eight process descriptions: Wet Mining, Dry Mining, Crushing/Screening, Humphreys Spiral, Drying, Dry Grinding, Wet Grinding, Drying Ground Mica. In these operation steps flake mica is produced from ore deposits of mica.

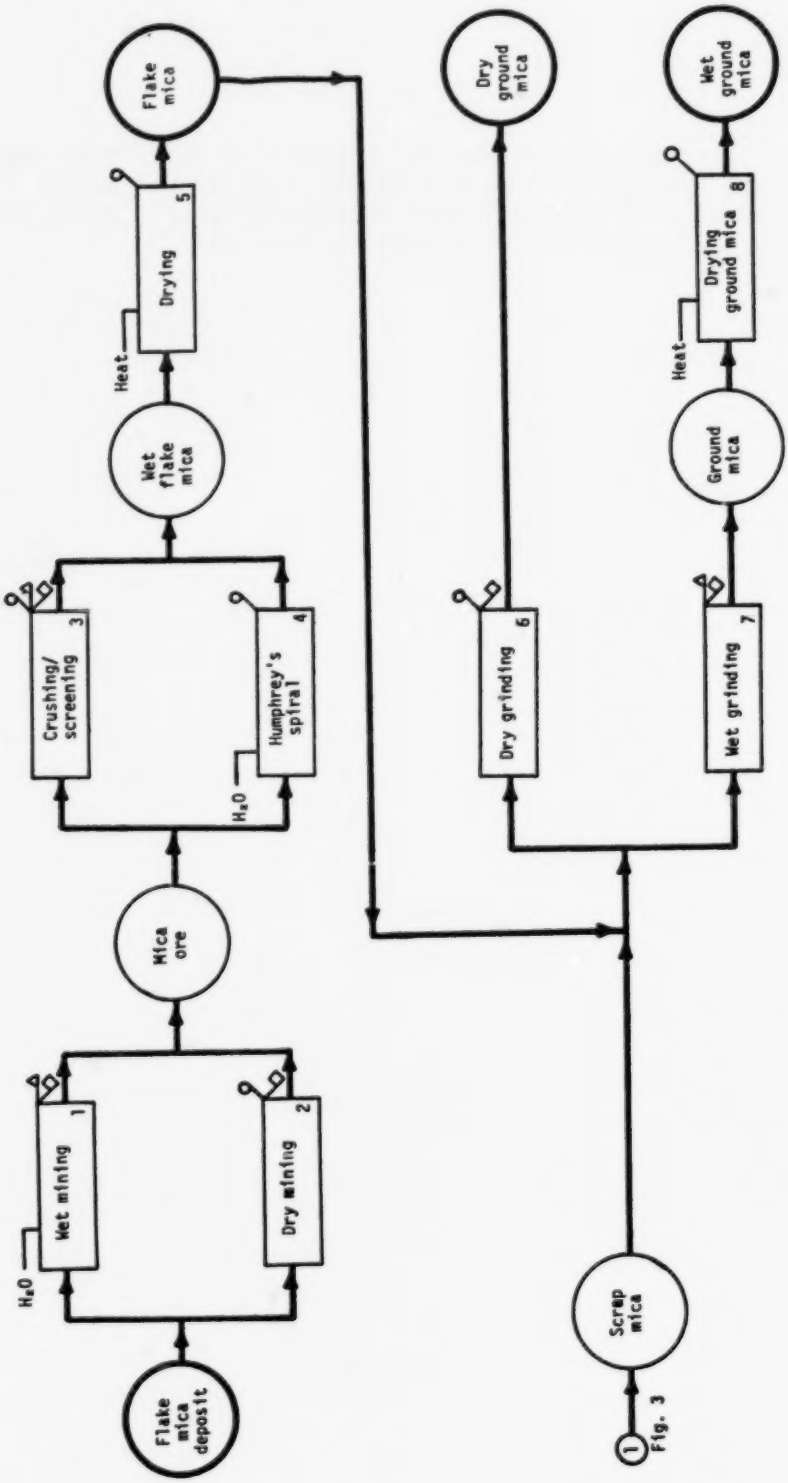

Figure 2. MICA PRODUCTION FLOWSHEET

MICA PRODUCTION

PROCESS NO. 1

WET MINING

1. Function

This process (see Figure 2) removes the mica ore from open-pit mines.

Water from high-pressure hydraulic nozzles breaks up the ore which then flows in suspension to a collection sump. The slurry is transported or pumped to the beneficiation plant, Process 3 or 4.

2. Input Materials

- 2 to 30 metric tons ore per metric ton ground mica product

3. Operating Parameters

- Ore veins - 1 to 40 meters in thickness
- Recoverable mica content - 3 to 90 percent
- Water pressure ~7 kg per cm^2
- Typical water flow rate - 3 to 15 m^3 per minute
- Equipment for overburden removal is assumed to be similar to that used in road building and earth moving.

4. Utilities

- Electrical energy - 12 to 18 kWh per metric ton ground mica product
- Water usage - 7 to 12 metric tons per metric ton ground mica product

5. Waste Streams

- 7 to 12 metric tons runoff water per metric ton ground mica product

6. EPA Source Classification Code

None

7. References

Lesure, F. G. Mica. In: U. S. Mineral Resources Geological Survey Professional Paper 820, U. S. Dept. of the Interior. Brobst, D. A., and W. P. Pratt (eds.). Washington, D. C., U. S. Government Printing Office, 1973. p. 415-422.

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Bulletin 650, U. S. Department of the Interior. Washington, D. C., U. S. Government Printing Office, 1970. p. 1083 - 1098.

MICA PRODUCTION PROCESS NO. 2

DRY MINING

1. Function

This process (see Figure 2) removes mica ore from open-pit mines to the beneficiation plant, Process 3 or 4.

Heavy equipment (bulldozers and dredglines) is used to remove overburden. Power shovels, trucks, and bulldozers remove and transport the ore to beneficiating, Process 3 or 4.

2. Input Materials

. 2 to 30 metric tons mica ore per metric ton ground mica product

3. Operating Parameters

. Ore veins 1 to 40 meters in thickness.
. Recoverable mica content 3 to 90 percent.
. Equipment is similar to that used for roadbuilding and earthmoving.

4. Utilities

. Fuel for vehicles - approximately 6000 kcal per metric ton ground mica product.

5. Waste Streams

. Dust emissions of unknown amount are released to the air.
. Overburden quantity varies over a wide range.

6. EPA Source Classification Code

None

7. References

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MICA PRODUCTION

PROCESS NO. 3

CRUSHING/SCREENING

1. Function

This process (see Figure 2) receives mined ore from Process 1 or 2, crushes the ore, and separates gangue from mica flakes.

The ore is roll-crushed and transported as a slurry to a series of screens. Gangue materials pass through the screens. Flat mica flakes are caught on the screens. They are then washed from the screens to a draining bin before drying, Process 5.

2. Input Materials

- 2 to 30 metric tons of ore per metric ton ground mica product.

3. Operating Parameters

- Typical crusher size - 1 x 2 meter opening.
- Ore compressive strength - 420 to 850 kg per cm^2.

4. Utilities

- Electrical energy - 15 kWh per metric ton ground mica product.
- Wash water - 5 cubic meters per metric ton ground mica product.

5. Waste Streams

- Solid wastes - 1 to 29 metric tons per metric ton ground mica product
- Liquid wastes - water amounting to 5 cubic meters per metric ton mica product and containing particulates in an amount up to 0.1 metric ton per metric ton ground mica product.
- Dust is emitted to the air from the crushing of the ore. No quantitative information is available.

6. EPA Source Classification Code

None

7. References

Handbook of Mineral Dressing. Taggart, A. F. (ed.). New York, John Wiley and Sons, Inc., 1945. p. 4-55 to 4-77.

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MICA PRODUCTION PROCESS NO. 4

HUMPHREYS SPIRAL

1. Function

This process (see Figure 2) crushes, washes, and separates mica from gangue. It then forwards the mica to drying, Process 5.

Primarily schist ore is crushed, usually in a jaw crusher, before it is wet-ground in a rod mill. The slurry is then fed to a Humphreys spiral which separates gangue minerals from the more easily suspended mica flake. The exiting mica concentrate is screened to eliminate water plus some remaining fine sand or clay slimes. The purified wet mica then goes to drying, Process 5.

2. Input Materials

. 2 to 30 metric tons ore per metric ton ground mica product.

3. Operating Parameters

. Typical spiral size - 0.6 meter x 0.6 meter floor space x 2 meters tall.
. Spiral capacity - 1-1/2 metric tons feed per hour containing 20 to 50 percent solids.
. Mica recovery - 75 percent.

4. Utilities

. Water - 5 to 100 cubic meters per metric ton ground mica product.
. Electrical energy - 15 kWh per metric ton ground mica product.

5. Waste Streams

. Dust is released to the air in the crushing process. No quantitative data are available.
. Wet tailings from the Humphreys spiral and water plus fines from the final screening are combined. This stream may vary from 5 to 100 cubic meters per metric ton ground mica product and may contain up to 30 percent solids. It is released to area streams.

6. EPA Source Classification Code

None

7. References

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MICA PRODUCTION PROCESS NO. 5

DRYING

1. Function

This process (see Figure 2) drys beneficiated mica from Processes 3 or 4 and forwards dry flake to Process 6 or 7. A screw feeder transports beneficiated mica to a rotary dryer. The dryer is a long cylinder mounted at a slight incline. It slowly revolves while the mica flake and combustion gases pass through. Lifters inside the dryer help expose the mica to the hot gases. A small portion of the dry flake is used in the manufacture of reconstituted mica and is not ground. The remainder is forwarded to grinding.

2. Input Materials

. 1.2 metric ton beneficiated mica flake per metric ton ground mica product.

3. Operating Parameters

. Dryer cylinder - 1 to 2 meters diameter x 3 to 10 meters long.
. 5 to 12 metric tons wet mica feed per hour

4. Utilities

. Electrical energy - 2 kWh per metric ton ground mica product
. Fuel - 100,000 kcal per metric ton ground mica product.

5. Waste Streams

. Combustion product gases from oil or coal fired dryers are released to the air. These gases may contain pollutants.

6. EPA Source Classification Code

None

7. References

Handbook of Mineral Dressing. Taggart, A. F. (ed.). New York, John Wiley and Sons, Inc., 1945. p. 17-08 to 17-12.

MICA PRODUCTION

PROCESS NO. 6

DRY GRINDING

1. Function

This process (see Figure 2) grinds 85 percent of the dry mica flake from Process 5, screens the ground product, and packages the product. Buhr Mills, rod mills, high-speed hammer mills, or micronizers grind dry flake mica. Air separators recycle oversize mica for additional grinding and discharge fine material to screens. Various fractions are bagged for marketing.

At present, high-speed hammer mills are most frequently used in dry-grinding.

2. Input Materials

. 1.1 metric tons dry flake mica per metric ton ground mica product.

3. Operating Parameters

. 1 to 3 metric tons product per hour with a 50 cm diameter hammer.

4. Utilities

. Electrical energy - 1 to 3 kWh per metric ton ground mica product.

5. Waste Streams

. 0.05 metric ton gangue per metric ton ground mica product.
. An unknown quantity of dust emissions to the air

6. EPA Source Classification Code

None

7. References

Petkof, B. Mica. In: Mineral Facts and Problems, Bureau of Mines Bulleton 650, U. S. Department of the Interior. Washington, D. C., U. S. Government Printing Office, 1970. p. 1083 - 1098.

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MICA PRODUCTION

PROCESS NO. 7

WET GRINDING

1. Function

This process (see Figure 2) grinds 15 percent of the dry mica flake from Process 5 and forwards the ground mica to Process 8.

Dry mica flake is fed into chaser mills which employ wood for grinding surfaces. The mill usually consists of a steel tank, lined with wooden blocks. Wooden rollers revolve at 15 to 30 rpm. Water and mica are fed into the mill to form a thick paste. When the mica is ground to the desired size, the tank contents are drained into settling bins. Heavy impurities sink. The mica slurry overflows to a settling tank.

2. Input Materials

. 1.1 metric tons flake mica per metric ton ground mica product.

3. Operating Parameters

. Chaser mills are usually 1 m deep x 3 m diameter with wheels about 75 cm in diameter.
. 5 to 8 hours grinding per batch.

4. Utilities

. Electrical energy - 2 kWh per metric ton ground mica product
. Water - 2 cubic meters per metric ton ground mica product.

5. Waste Streams

. 0.05 metric ton solids per metric ton ground mica product
. 1 metric ton water per metric ton ground mica product is released. This water may contain up to 2 percent solids.

6. EPA Source Classification Code

None

7. References

Taggart, A. F. (ed.). Handbook of Mineral Dressing. New York, John Wiley and Sons, Inc., 1945. p. 3-64 to 3-66.

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DRYING GROUND MICA

1. Function

This process (see Figure 2) dries wet-ground mica from Process 7, screens it, and bags it for shipment.

Steam-heated kettles or rotary dryers are used to drive water from the mica.

2. Input Materials

. 2 metric tons wet-ground mica per metric ton ground mica product.

3. Operating Parameters

. 1 kg water evaporated per 1.5 kg steam used.
. 0.7 kg per cm^2 steam pressure.

4. Utilities

. Fuel - 500,000 kcal per metric ton ground mica product.

5. Waste Streams

None

6. EPA Source Classification Code

None

7. References

Handbook of Mineral Dressing. Taggart, A. F. (ed.). New York, John Wiley and Sons, Inc., 1945. p. 17-10 to 17-12.

Petkof, B. Mica. In: Mineral Facts and Problems, Bureau of Mines Bulletin 650, U. S. Department of the Interior. Washington, D. C., U. S. Government Printing Office, 1970. p. 1083 - 1098.

Mica Disc Production

The Mica Disc Production Segment of the Mica Industry processes a very small volume of material. Data on processing parameters are meager.

The flowsheet of Figure 3 shows the single punching process of the Mica Disc Segment. The symbols used in the process block are described in the Industry Analysis section of this report.

Scrap mica from this process is recycled to the Mica Production Segment as shown on the flowsheets, Figure 2 and Figure 3.

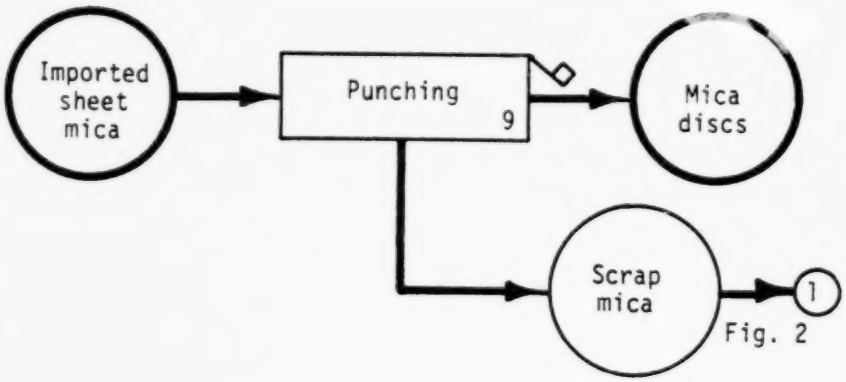

Figure 3. MICA DISC SEGMENT FLOWSHEET

MICA DISC PRODUCTION PROCESS NO. 9

PUNCHING

1. Function

   This process (see Figure 3) receives primarily imported sheet mica and punches it into discs of specified shapes and sizes.

   Power presses are used to punch discs from imported hand "cobbed" and "rafted" sheet mica.

2. Input Materials

   . 1.2 metric ton sheet mica per metric ton punched discs.

3. Operating Parameters

   -

4. Utilities

   . Electrical energy - 50 kWh per metric ton punched discs.

5. Waste Streams

   . 0.2 metric tons scrap per metric ton punched discs is used as feed in the grinding process. (Figure 2, Process 6 or 7).

6. EPA Source Classification Code

   None

7. References

Montague, S. A. Mica. In: Industrial Minerals and Rocks. Gillson, J. L. (ed.). New York, American Institute of Mining, Metallurgical, and Petroleum Engineers, 1960. p. 551-566.

APPENDIX A

COMPANIES AND PRODUCTS

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Table A-1. PRODUCERS OF CRUDE FLAKE MICA

Company	Company Location	Location of Operation
George Bland	Custer, South Dakota	Custer Co., South Dakota
Buckeye Mica Co.	Buckeye, Arizona	Buckeye Co., Arizona
Deneen Mica Co.	Newdale, N. Carolina	Yancy Co., N. Carolina
Deneen Mica Co., Inc.	Burnsville, N. Carolina	Yancy Co., N. Carolina
Drifted Snow 1 and 2	Canoga Park, California	Imperial Co., California
The Feldspar Corp.	Spruce Pine, N. C.	Mitchell Co., N. Carolina
The Feldspar Corp.		
Sullins Mine	Spruce Pine, N. C.	Mitchell Co., N. Carolina
Monticello Mine	Spruce Pine, N. C.	Jasper Co., N. Carolina
Wiseman Mine	Spruce Pine, N. C.	Mitchell Co., N. Carolina
Foote Mineral Co.	Kings Mountain, N. C.	Cleveland Co., N. C.
Franklin Mineral Products Co.	Wilmington, Maine	Hart Co., Maine
Gulf Resources Lithium Corp.of Am.	Gastonia, N. Carolina	Cleveland Co., N. C.
Harris Mining Co.		
Brushy Creek Mine	Spruce Pine, N. C.	Avery Co., N. Carolina
Gusher Knob Mine	Spruce Pine, N. C.	Avery Co., N. Carolina
Jarita Mining and Investment Co.	Espanola, New Mexico	Rio Arriba Co., N. M.
Russell A. Johnson	Ft. Collins, Colorado	Larimer Co., Colorado
Jones Mining Co., Inc.	Waleska, Georgia	Cherokee Co., Georgia
L. W. Judson	Hermosa, S. Dakota	Pennington Co., S. D.
Kings Mtn. Mica Co.		
Moss Mine	Kings Mountain, N. C.	Cleveland Co., N. C.
Patterson Mine	Kings Mountain, N. C.	Cleveland Co., N. C.
Lawson United Feldspar Mining Co.	Spruce Pine, N. C.	Mitchell Co., N. C.
Mineral Industrial Commodities of America, Inc.	Santa Fe, New Mexico	Taos Co., New Mexico
The Mineral Mining Corp.	Kershaw, S. Carolina	Lancaster Co., S. C.

(Continued)

Table A-1. (continued). PRODUCERS OF CRUDE FLAKE MICA

Company	Company Location	Location of Operation
Richard O'Laughlin	Custer, South Dakota	Custer Co., South Dakota
Pacer Corporation	Custer, South Dakota	Custer Co., South Dakota
Pendleton Mining Co.	Keystone, N. Dakota	Undefined Co., S. Dakota
San Antonio Mine Co.	Ajo, Arizona	Pima Company, Arizona
Thompson-Weinman & Co.	Cartersville, Georgia	Cherokee Co., Georgia
U.S. Beryllium Corp.	Pueblo, Colorado	Chaffee Co., Colorado
V. B. West	Amarillo, Texas	Maricopa Co., Arizona
Western Energy Corp. Rio Arriba Minerals	Santa Fe, New Mexico	Rio Arriba Co., N. M.
Western Mica Co.	Chicago, Illinois	Randolph Co., Alabama
Div'n of U.S. Gypsum Kings Mountain Mine	Chicago, Illinois	Cleveland Co., N. C.

Table A-2. PRODUCERS OF WET-AND DRY-GROUND MICA

Company	Company Location	Location of Operation
Arrow Mining	Hot Springs, S. Dakota	Fall River Co., S. Dakota
Asheville Mica Co.	Newport News, Virginia	Buncombe Co., N. Carolina
George Bland	Custer, South Dakota	Custer Co., South Dakota
Buckeye Mica Co.	Buckeye, Arizona	Maricopa Co., Arizona
Concord Mica Corp.	Wayland, Maine	Merrimack Co., N. Hampshire
Deneen Mica Co.	Newdale, N. Carolina	Yancy Co., N. Carolina
Diamond Mica Co.	Middleton, Cn.	Middlesex Co., Cn.
Diamond Mica Co.	Spruce Pine, N. C.	Yancy Co., N. Carolina
Diamond Mica Co.	Spruce Pine, N. C.	Mitchell Co., N. C.
The English Mica Co.	Stamford, Cn.	Cleveland Co., N. C.
Franklin Mineral Products Co.	Wilmington, Maine	Hart Co., Georgia
Franklin Mineral Products Co.	Wilmington, Maine	Macon Co., Georgia
General Electric Corp.	Schnectady, New York	County - Undefined
General Electric Corp.	Schnectady, New York	Coshocton Co., Ohio
Harris Mining Co.	Spruce Pine, N. C.	Mitchell Co., N. C.
Kings Mountain Mica Co., Inc.	Kings Mountain, N. C.	Cleveland Co., N. C.
Lawson United Feldspar and Mineral Co.	Minpro, North Carolina	Mitchell Co., N. Carolina
Micalith Mining Co.	Phoenix, Arizona	York Co., Pennsylvania
Mineral Industries Commodities of America, Inc.	Santa Fe, New Mexico	Santa Fe Co., New Mexico
Mineral Mining Corp.	Kershaw, S. C.	Lancaster Co., S. C.
Pacer Corp.	Custer, S. D.	Brule Co., S. Dakota
Thompson-Weinman & Co	Cartersville, Georgia	Bartow Co, Georgia
U.S. Gypsum Co.	Chicago, Illinois	Cleburne Co., Alabama
U.S. Gypsum Co.	Chicago, Illinois	Tarrant Co., Texas
U.S. Mica Co., Inc.	Stamford Conn.	Cook Co., Illinois
Western Energy Corp. Rio Arriba Minerals	Santa Fe, New Mexico	Rio Arriba Co., N. M.
J. H. Wood, Jr.	Huntsville, Alabama	Marion Co., Alabama

Table A-3. PRODUCERS OF MICA DISCS AND SPLITTINGS

Company	Company Location	Location of Operation
American Mica Insulation Co.	Manasquan, New Jersey	Monmouth Co., New Jersey
Asheville Mica Co.	Newport News, Virginia	Newport News Co., Va.
Carpenter & Phillips Mica Co.	Spruce Pine, N. C.	Mitchell Co., N. Carolina
Cleveland Mica Co.	Lakewood, Ohio	Franklin Co., Ohio
Industrial Mica Div. of Columbia Technical Corp.	Englewood, New Jersey	Bergen Co., New Jersey
Micacraft Products, Inc.	Newark, New Jersey	Essex Co., New Jersey
Mica Fabricating Co.	Rochelle Park, N. J.	Bergen Co., New Jersey
New England Mica Co., Inc.	Needham Heights, Maine	Norfolk Co., Maine
Reliance Mica Co., Inc.	Brooklyn, New York	Kings Co., New York
Spruce Pine Mica Co., Inc.	Spruce Pine, N. C.	Mitchell Co., N. C.
The Tar Heel Mica Co., Inc.	Plumtree, N. Carolina	Avery Co., N. Carolina
Victory Mica Mfg. Co., Inc.	Brooklyn, New York	Kings Co., New York